Sentiment and firm behavior during the COVID-19 pandemic☆

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ABSTRACT

How did optimism or pessimism about the duration of shutdowns during the COVID-19 pandemic affect firms' business outlook and behavior? In a large panel of German firms, we identify sentiment as the only plausible determinant of the cross-sectional variation in the expected shutdown length because this variation is uncorrelated with fundamentals. Firms incorporate this sentiment regarding the shutdown duration in their more general business outlook. Sentiment was also an important determinant of firms' crisis response: More pessimistic firms—those that perceived the shutdown to last longer—were more likely to implement strong measures like layoffs or canceling investments. The implementation of soft measures, e.g., working from home, was unrelated to the sentiment regarding the shutdown length.

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1. Introduction

Recent theoretical work highlights sentiment—optimism or pessimism manifested in expectations but unrelated to fundamentals—as an important driver of economic activity (e.g., Angeletos and La'O, 2013; Benhabib et al., 2015). However, micro-level evidence on the link between sentiment-driven expectations and behavior is scarce—especially for the case of firms.

This paper studies how sentiment-driven expectations affect firms' business decisions by exploiting the unprecedented nature of the COVID-19 pandemic. Early in the crisis, governments implemented a shutdown of a significant share of eco-

nomic activity in many countries, without clear perspective of when the situation would be back to normal.[1] This was also the case in Germany where the government refrained from imposing an outright curfew in March 2020, but banned social contacts in public, closed schools, child care facilities, sport facilities and most service enterprises, strongly advised to use working from home, and imposed travel restrictions. Amid this unclear situation, firms had to make decisions on how to adapt to the crisis.

We use expectation data from the April 2020 wave of the ifo Business Survey (IBS), which covers roughly 5,000 German firms, to investigate whether and how firms' sentiment-driven expectations about the duration of the shutdown that was implemented in response to the COVID-19 pandemic affected their managerial decisions.

Measuring sentiment in expectations is challenging: It requires a setting in which it can be plausibly ruled out that variation in expectations is driven by variation in (private) information. In a first step, we thus argue that, early in the pandemic, the cross-sectional variation in firms' expectations indeed reflected different degrees of optimism or pessimism about the length of the shutdown rather than differences in information.[2] This is plausible as the situation in April 2020 was fundamentally uncertain; even policymakers could arguably not foresee the future path of pandemic-related policies. Also, firms had not anticipated—and thus had not had private information about—the shutdown measures implemented in the second half of March 2020, as shown by Buchheim et al. (2021). On top of that, we demonstrate that the shutdown duration expectations were unrelated to potential sources of idiosyncratic information such as the initial, idiosyncratic impact of the COVID-19 crisis on firms' business conditions or the local pandemic situation. The shutdown duration expectations are also unrelated to the business situation prior to the pandemic as well as to a number of proxies for firms' information processing capabilities. Because they cannot be explained by all these factors, the cross-sectional differences in shutdown duration expectations plausibly reflect firms' "gut feeling" regarding how long the policy measures to combat the pandemic would be in place. In other words, differences in expectations are driven by sentiment, which allows us to causally interpret the effect of expectations on business decisions.

In a second step, we find that firms' sentiment about the shutdown duration explains their choices of forward-looking business strategies to mitigate the consequences of COVID-19. In particular, firms that believed the shutdown to last for more than four months were 22 to 29 percent more likely to implement strong responses with high fixed costs—canceling investment or dismissing employees—than the average firm that expected a quick return to normalcy. In contrast, firms implemented relatively inexpensive measures, like working from home or short time work—i.e., a temporal reduction in working hours, for which the government compensates part of employees foregone earnings—independently of the expected length of the shutdown. Noteworthy, these effects are prevalent after controlling for pre-crisis firm health and the concurrent impact of the COVID-19 crisis on firms' businesses, which we find to be important determinants of firms' responses to the crisis on their own.

The effects of sentiment on managerial decisions are consistent with their effects on the general business outlook of firms. We show that firms' shutdown expectations are not predictive for the reported initial crisis impact, but constitute an important determinant of their business outlook going forward. For example, firms that believed the shutdown to last for longer than four months reported a five percentage point higher expected decline in revenues due to the COVID-19 crisis than firms expecting the shutdown to last for less than two months, even after controlling for the initial business impact of the crisis.

Taken together, our results suggest that the perceived length of the shutdown, and, in extension, the perceived time path for reopening the economy, is primarily driven by sentiment, affects firms' general business outlook and influences the choice of strategies that firms implemented to deal with the crisis.

Our paper makes several contributions to the literature. We provide first micro-level evidence that sentiment drives managerial choices.[3] Our results, hence, provide support for recent theoretical work arguing that sentiment may be important for managerial decisions in a way that is in line with observed aggregate fluctuations (e.g., Angeletos and La'O, 2013; Benhabib et al., 2015). In this respect, our paper is closely related to recent studies examining the link between consumer sentiment and consumption choices at the household level. Mian et al. (2022) highlight that sentiment shocks after elections do not have significant effects on household spending, while Gillitzer and Prasad (2018) and Makridis (2019) provide evidence that changes in individuals' sentiment affect consumption. The latter finding is also supported by the co-movement of consumer sentiment and GDP in state-level (Benhabib and Spiegel, 2019) and aggregate (e.g., Barsky and Sims, 2012; Lagerborg et al., 2020) data.

Our results also add to the emerging strand of literature that investigates the more general link between firms' (macroeconomic) expectations and their decisions. Difficulties in identifying exogenous variation in firms' expectations as well as a lack of data containing both expectations and business decisions make it challenging to empirically study this potential

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[1] See Hale et al. (2020) for a detailed account of global policy responses—in particular the stringency of restrictions—to the COVID-19 pandemic.

[2] If the government's decision on the duration of the shutdown largely depends on the pandemic situation, firms' shutdown duration expectations could also reflect their more general expectations regarding the overall further progression of the crisis.

[3] Our work is related to two complementary strands of literature. A small number of studies analyzes the impact of managerial sentiment on capital structure decisions but rely only on aggregate proxies of managerial sentiment (e.g., Mefteh and Oliver, 2010; Boubaker and Hamza, 2014). A larger body of literature, summarized by Malmendier and Tate (2015), deals with the issue of structural overconfidence among business leaders.

key determinant of firms' hiring and investment.[4] Recently, Coibion et al. (2018) and Coibion et al. (2020) use experiments involving information treatments to show how differences in inflation expectations of firms causally affect firms' decisions on prices, employment, and investment. Boneva et al. (2020) use an instrumental variables approach to a similar end. In addition to these studies establishing causal effects, Gennaioli et al. (2015), Tanaka et al. (2020), and Dovern et al. (2020) document that managerial expectations correlate with business decisions.

In the context of the COVID-19 pandemic, this paper is first in highlighting how firms' expectations about the progression of the pandemic shaped their business decisions. Only few other papers describe firms' decisions during the first wave of the pandemic, however without focusing on the role of their expectations about the further progression of the crisis. Bartik et al. (2020) and Alekseev et al. (2022) provide broad, mostly descriptive snapshots on the extent to which firms in the U.S. are affected by the crisis and how they planned to deal with the ensuing disruptions. Alstadsæter et al. (2020) summarize characteristics of Norwegian firms that laid off workers early in the crisis; their focus, however, is on the socio-economic characteristics of dismissed employees. Our work is also related to Altig et al. (2020), Baker et al. (2020), Hassan et al. (2020), and Meyer et al. (2021) who study the effect of the COVID-19 pandemic on expectations and subjective uncertainty of firms, but without considering the managerial responses.[5]

The remainder of this paper is structured as follows. Section 2 describes the survey data. Section 3 presents our identification strategy and evidence that variation in shutdown duration expectations is rooted in sentiment rather than (private) information. In Section 4, we present evidence on how the COVID-19 pandemic and, in particular, sentiment about the duration of the implemented shutdown have influenced the general business outlook of firms and firms' managerial responses. Section 5 concludes.

2. Data: the ifo business survey

Our main data source is the ifo Business Survey (IBS). The IBS is a long-standing monthly survey among a large sample of German firms across all sectors that aims at being representative for the German economy.[6] It covers various dimensions of firms' business activities, including their current and expected business conditions. Importantly, survey respondents are asked to only refer to domestic plants and subsidiaries when answering the IBS. Appendix B documents the translated wording of all questions used in this paper.

We restrict the analysis to the IBS wave of April 2020 that included supplementary questions related to the COVID-19 pandemic.[7] In particular, the survey asked i) how long firms expected the restrictions of public life in Germany to last (in months) (henceforth, "expected shutdown duration"), ii) how strongly the COVID-19 crisis had already affected firms' business conditions ("COVID-19 impact" on a scale from -3 ("negative") to +3 ("positive"))[8], iii) the expected percent change in revenues due to the COVID-19 crisis ("COVID-19 revenue effect"), and iv) which measures firms had already taken in response to the pandemic with a list of (non-exclusive) answers that included, inter alia, "more working from home", "short time work", "reduction of employment", "postponement of investment projects", and "cancellation of investment projects".[9]

We exploit the panel dimension of the IBS to construct measures of pre-crisis firm health and to merge additional firm characteristics not included in the April 2020 wave of the IBS. Specifically, we use firms' reported business conditions from the IBS waves in October through December 2019 to control for pre-trends at the firm level. In addition, we use firms export share as of September 2018 and expectations of GDP growth in 2020 as elicited in August 2019.[10]

Overall, our sample comprises 4821 firms that responded to the IBS in April 2020 and during the last quarter of 2019. 1749 of these were in manufacturing (IBS-IND, 2020), 1668 in services (IBS-SERV, 2020), and 1404 in retail/wholesale (IBS-TRA, 2020).[11] Figure A1 and Table A2 in Appendix A document that the response to and dropout from the IBS in April was

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[4] There is a larger—yet also very recent—literature on the effect of expectations of private households on their decisions. Most of this literature relies on the analysis of correlations between expectations and decisions and focuses on the identification of heterogeneity driven by socioeconomic characteristics (Bachmann et al., 2015; D'Acunto et al., 2019; Dräger and Nghiem, 2021). A number of very recent studies identifies causal effects from households' expectations on decisions using information treatments or natural experiments (Coibion et al., 2019; Roth and Wohlfart, 2020; D'Acunto et al., 2022).

[5] Relatedly, there is a growing literature on the effect of the pandemic on economic beliefs and sentiment among consumers and households including Fetzer et al. (2020) and Bui et al. (2021).

[6] The IBS provides input for the ifo Business Climate Index, the most recognized leading indicator for the German business cycle, see Sauer and Wohlrabe (2020) for details on the IBS. Sauer and Wohlrabe (2019) document that questions are usually answered by senior managers. As a consequence of the long-standing nature of the IBS, young firms and start-ups are underrepresented.

[7] Buchheim et al. (2021) show that firms' business outlook decreased strongest after the announcement of nation-wide school closures on March 13. Since roughly three out of four respondents of the March wave answered the survey before this date, April 2020 is the first month in which all survey respondents were under the impression of the COVID-19 crisis.

[8] We deliberately asked for "business condition" in this context as the main survey questions of the IBS ask for an assessment of current and expected business conditions, see Q6 and Q7 in Appendix B. Hence, respondents are very familiar with this concept. Based on a meta survey, Sauer and Wohlrabe (2020) document that firms mostly refer to their current and expected profits and sales when they answer these questions on business conditions of the IBS.

[9] In general, the response rate for the COVID-19-related supplementary questions was high. More than 97.2% of firms that responded to the survey in April answered at least three of these four special questions.

[10] To maintain the sample size in our regressions below, we set the export share to the average of the two-digit industry if missing. Moreover, we winsorize the GDP growth expectations at the 1st and 99th percentiles to limit the effect of outliers.

[11] Data harmonization across sectors follows Link (2020). In particular, this involves the cleaning and assignment of industry codes of the official German industry classification system WZ08.

comparable to previous months and not related to business conditions and expectations reported prior to the crisis or in the subsequent IBS waves. Table A1 in Appendix A summarizes basic descriptive statistics for the variables used in this paper.

By the time of the survey in April 2020, the firms were already strongly hit by the effects of the COVID-19 pandemic. The average firm stated to be strongly adversely affected by the COVID-19 crisis; the mean "COVID-19 impact" was −1.53. Only 19.7% of firms reported that they were not negatively affected by the pandemic. This strong negative effect of the pandemic is also reflected in the expected business conditions, which are regularly elicited on a trichotomous scale (−1 "more unfavorable", 0 "roughly the same", 1 "more favorable") and averaged at −0.57 in April. Both the drop relative to March and the low April level constitute historical records. Firms were also pessimistic regarding the further effects of the crisis on their business. On average, they expected their revenues in 2020 to drop by 21% relative to a hypothetical non-pandemic scenario.

Firms in our sample reported whether or not they implemented one or more of a variety of crisis response strategies by April. The most frequent response was to use the possibility for employees to work from home (63.8%). Half of the firms (49.7%) reported to use the short time work scheme which is consistent with official statistics suggesting that the number of employees on short time work reached a record high of approximately six million in April (Bundesagentur für Arbeit, 2020). In addition, 16.2% of firms reported that they had already reduced their workforce. Many firms were reluctant to invest and either postpone investment projects (43.2%) and/or cancel them altogether (20.5%).

3. Identification strategy

The expected shutdown duration, which measures how long firms expected the restriction on public life to last, is the main covariate of interest. Firms reported these expectations in April 2020, when the policy measures to combat the pandemic were in place for one month at most.

Given that the pandemic in general and the related policy measures in particular were a completely new situation for everyone including firms, and given that all information about possible policies to slow the spread was in the public domain, it seems plausible that the cross-sectional variation in the expected shutdown duration reflects firms' idiosyncratic "gut feeling" about future pandemic-related policies. This means that the differential assessments of the duration of the pandemic-related shutdown in the early weeks of the crisis reflect differences in the firm-level sentiment rather than differential private information of firms.

In this section, we present evidence that the variation in the expected shutdown duration is unrelated to fundamentals or private information, and thus primarily driven by sentiment. To fix ideas, let x_i denote the expected shutdown length of firm i, and let x_i be given by

$$x_i = \hat{x}_i(I_i) + \omega_i + \xi_i, \quad \text{with} \quad \xi_i \perp I_i, \omega_i. \tag{1}$$

In (1), $\hat{x}_i(I_i)$ denotes the part of a firm's expectations that is driven by its information I_i, ω_i denotes the intrinsic, long-run optimism or pessimism of a firm (analogously to, e.g., Bachmann and Elstner, 2015), and ξ_i is the short-run sentiment that is independent of $\hat{x}_i$ and ω_i (analogously to the formulation in Angeletos and La'O, 2013).

In the remainder of this section, we will argue that the cross-sectional variation in expectations x_i is primarily driven by idiosyncratic sentiment ξ_i by demonstrating that x_i is uncorrelated with potentially idiosyncratic sources of information, firms' optimism or pessimism about their business development, and to potential differences in information processing as embodied in $\hat{x}_i(\cdot)$.

There is no indication for differential degrees of private information of firms about the future path of pandemic-related policy in April 2020 along several dimensions. First, Buchheim et al. (2021) show, for the same firm panel, that firms did not anticipate the implementation of COVID-19-related policies in Germany before April 2020: Both the announcement of school closures on March 13th and the far-reaching ban of social contacts (such as the ban of social gatherings of more than five people, the closure of non-essential businesses and services, a ban on religious meetings, but no outright curfew) on March 22nd led to jumps in business perceptions and uncertainty around these particular dates. In contrast, there were at best small changes in perceptions and uncertainty during January, February, and early March, when the pandemic spread through Asia and reached Europe. Notably, the dynamics of business perceptions before the implementation of COVID-19-related policies also do not vary with proxies for potential information sources for the spread of the pandemic, like firms' sector or their trade exposure. This means that firms did not possess better information than the public about the progression of the pandemic and pandemic policy before major policy measures were actually implemented.

Second, the distribution of firms' shutdown expectations, which is displayed in Figure A2 in Appendix A, shows that there was no consensus as to how long the policy restrictions would be in place. While about half of the firms were, from an ex post perspective, rather optimistic and expected the restrictions to be lifted after three months, 15 percent of firms expected them to last for half a year, and seven percent of firms expected the restrictions to be in place for 10 months and longer. This wide range of expectations—the standard deviation is 3.4 months—reflects that there was no reliable information on the future German policy response to the pandemic in April 2020.

Third, firms did not resort to the initial impact of the COVID-19 crisis on their own businesses as a potential source of idiosyncratic information when formulating expectations about the shutdown length. Panel (a) of Fig. 1 shows that the conditional means of the expected shutdown duration are equal across the values of the self-reported COVID-19 impact on firms' businesses (integers between −3 and 3), and the conditional distributions are comparable. The same holds at
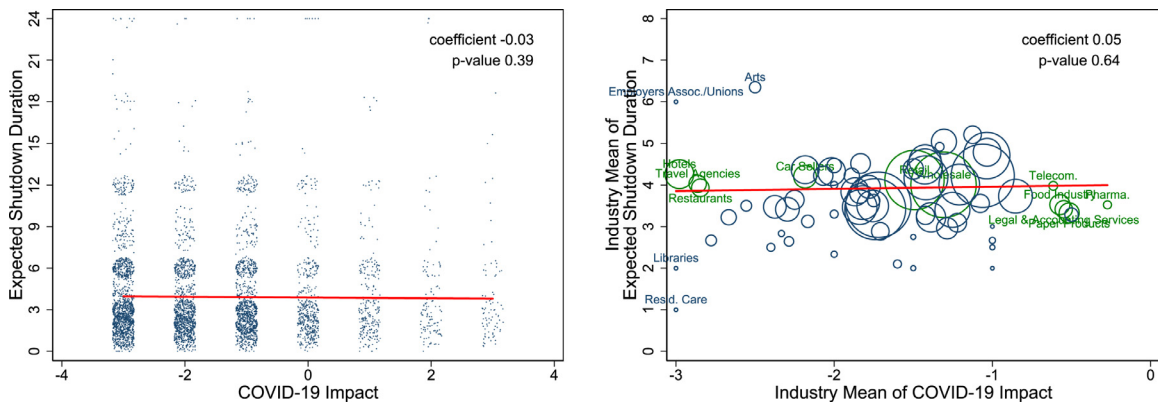
Fig. 1. Expected Shutdown Duration and COVID-19 Impact. *Notes:* Panel (a) plots, after adding small random errors to the discrete values for better visibility, the expected shutdown duration (in months and censored at 24 months for readability) against the COVID-19 impact (measured by integers between −3 "negative impact" and 3 "positive impact") at the firm level both elicited in the April wave of the IBS. Panel (b) plots the industry-specific mean of firms' expected shutdown duration against average COVID-19 impact on business activity at the levels of two-digit industries. Industry-averages are weighted by the number of firms per industry indicated by the bubble size.

the industry level in Panel (b): Firms in industries that were initially more adversely affected by the crisis did not expect the restrictions on public life to be in place for a longer or shorter period of time than firms in less affected industries. For example, the duration expectations of the heavily hit hospitality industry (restaurants and hotels, travel agencies) are, on average, nearly identical to retail and wholesale firms—of which some were hit badly while others were not—and the telecommunication, pharmaceutical, or paper products industries which report to not have been hit by the pandemic at all. Both of these results, thus, support the interpretation of duration expectations as a purely forward-looking measure of sentiment about the shutdown duration.

Fourth, the data also suggests that firms did not base their expected shutdown duration on the local spread of COVID-19 or the stringency of the local public containment measures, as shown in the top row of Fig. 2.[12] In Panel (a), we plot expected shutdown durations against the incidence rate of new COVID-19 infections as of April 1st, 2020, within the county of the firm's location. Panel (b) plots expected shutdown durations against a stringency index of county-level public containment measures as of April 1st, 2020.[13] The figures show that there is no correlation between the expected shutdown length and the local COVID-19 situation at the time when the expectations were formed. Moreover, the expected shutdown length is also not predictive of the future cross-county variation in the future stringency of the containment measures, as shown in Table A6 in Appendix A. These results thus suggest that local information is not a determinant of the cross-sectional variation in the expected shutdown duration.

Thus far, we have shown that firms' idiosyncratic exposure to COVID-19—either via their businesses or via their locality—as potential source for differing information sets I_i did not lead to different assessments regarding the future progression of the crisis. The remaining rows of Fig. 2 demonstrate that the shutdown expectations are also unrelated to firms' general assessments of their businesses, i.e., variation of ω_i in (1). More specifically, the second row of Fig. 2 shows that there is no relation between firms' pre-pandemic business situation in Q4 2019, as measured by the reported business conditions in Panel (c) and whether firms were optimistic or pessimistic about the shutdown duration, and a marginally significant but quantitatively negligible relation between expected shutdown duration and the six months ahead business expectations in Panel (d). The third row shows that the expected shutdown duration's relation to firms' optimism or pessimism, measured as to whether they consistently over- or underpredict their own business developments in the spirit of Bachmann and Elstner (2015), is at most borderline significant and economically very weak (Panel (e)),[14] and unrelated to their August 2019 expectations regarding GDP growth for 2020 (Panel (f)).

A final potential confounder for the interpretation of the variation in expected shutdown duration as sentiment-driven is that this variation may reflect differences in the information processing capabilities of firms. In model (1) above, this would mean that different firms process the same information I in different ways, that is, $\hat{x}_i(\cdot)$ varies across firms. Yet, Fig. 3 presents evidence that this is unlikely. Here, we plot the cumulative distribution functions of the expected shutdown duration for sample splits according to three different proxies for firms' information processing capability: firm size (as captured by the number of employees), firm age, and export share, where the latter may impact the interpretation of the COVID-19 infections through the lens of trade partners' prior experiences with pandemic-related policies. The figure shows that the variation in shutdown duration expectations is strikingly similar across these different groups of firms, suggesting that information processing capabilities have little effect on the expected policy response to the pandemic. Table A4 in Appendix A further reinforces this finding by demonstrating that the average shutdown duration expectations are not statistically differ-

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[12] Table A3 in Appendix A makes the same point by showing that there are no economically meaningful differences in the means of these observables—and the initial COVID-19 impact—for shutdown expectations above and below the median.
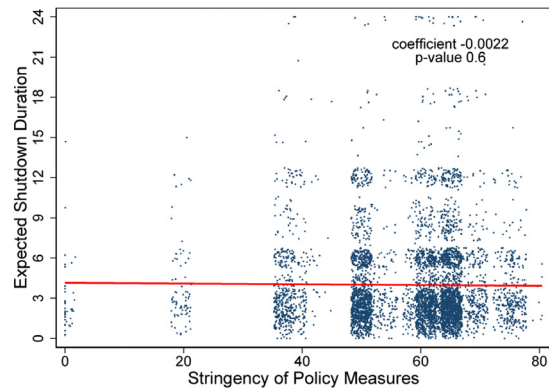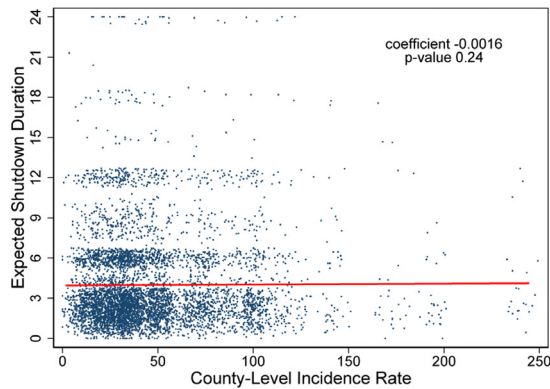
(a) County-Level Incidence Rate as of Apr 1, 2020 (b) County-Level Stringency of Containment Measures as of Apr 1, 2020
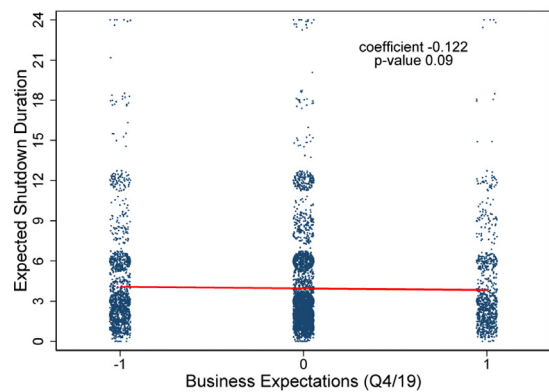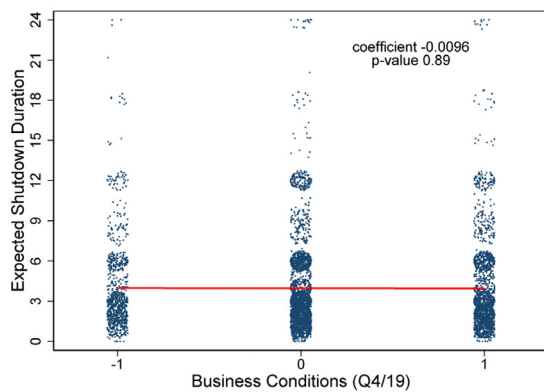
(c) Business Conditions as of Q4/2019

(d) Business Expectations as of Q4/2019
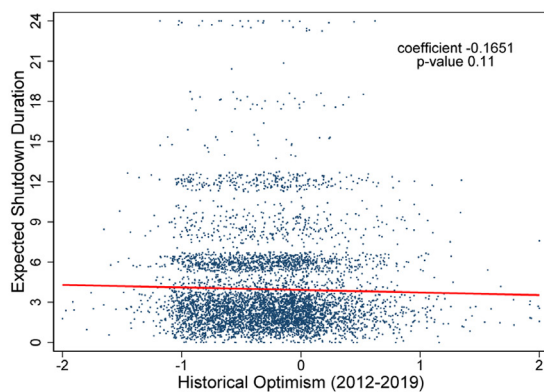
(e) Historical Optimism

(f) Expected 2020 GDP Growth as of 8/2019

Fig. 2. Expected Shutdown Duration and Observables at the Firm- and County-Level. *Notes:* Each figure plots, after adding small random errors to the discrete values for better visibility, the expected shutdown duration elicited in the April wave of the IBS against firm- and county-level observables. For readability, the expected shutdown duration is censored at 24 months. The first row plots the expected shutdown duration against the incidence rate of new COVID-19 infections as of April 01, 2020 (censored at an incidence rate of 250 for better readability) in Panel (a) and a stringency index of public containment measures that were in place on April 01, 2020 in Panel (b), both measured at the level of the county each firm is located in. See Footnote [13] for source and definition of the stringency index. The second row plots the expected shutdown duration against firms' business outlook in Q4 2019 (reported business conditions in Panel (c) and expected business conditions for the next six months—including the first months of 2020—in Panel (d)). The third row plots the expected shutdown duration against historical optimism (for the definition see Footnote [14]) in Panel (e) and the firms' expected GDP growth for 2020 as elicited in August 2019 in Panel (f).

(a) Split by Number of Employees   (b) Split by Firm Age   (c) Split by Export Share
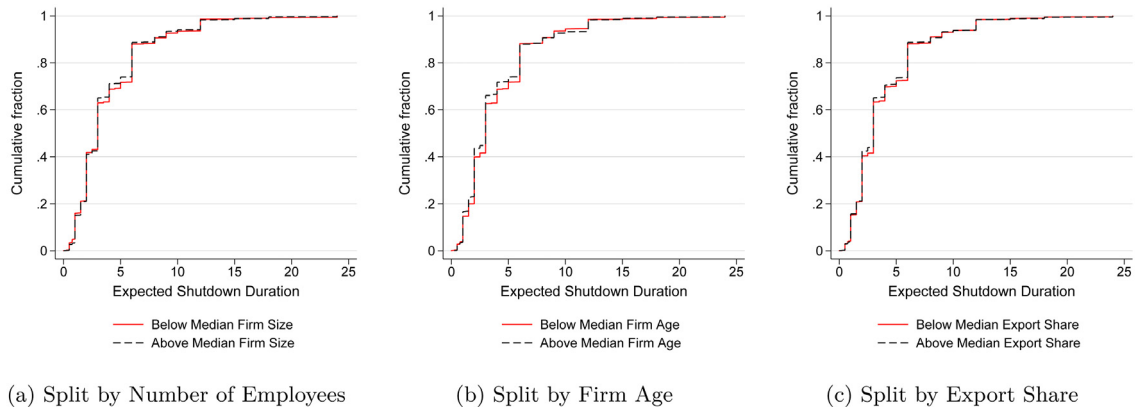
Fig. 3. Determinants of Shutdown Duration Expectations: Firm-Specific Information Processing Capability. *Notes:* This figure shows the cumulative distribution functions of expected shutdown duration of samples of firms split at the median of three different proxies of firms' information processing capability: firm size (as captured by the number of employees), firm age, and export share. Shutdown duration expectations are winsorized at 24 months for the sake of exposition.
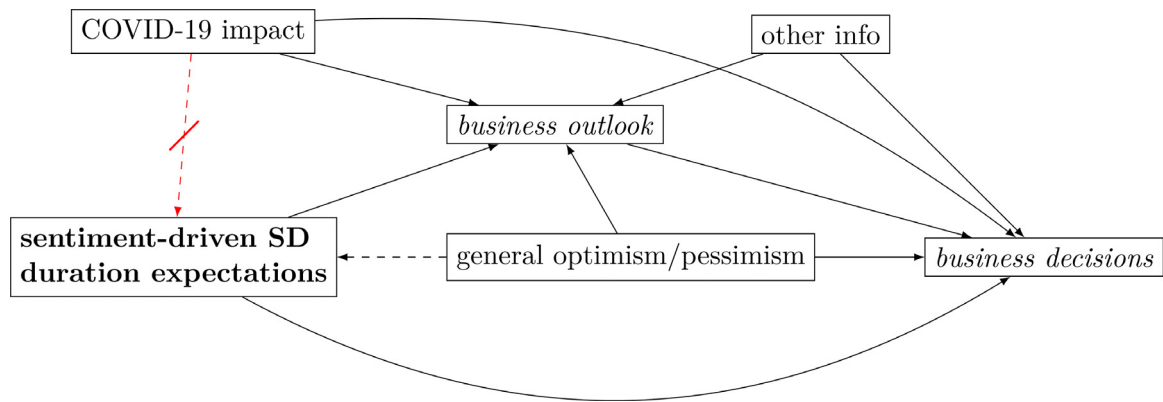
Fig. 4. Directed Acyclical Graph of the Identification Strategy. *Notes:* This figure shows the identification strategy underlying the analysis in Section 4. We seek to estimate the effect of *sentiment-driven shutdown (SD) duration expectations* on measures for the *business outlook* and *business decisions*. See the text for details.

ent between the groups defined by the sample splits and that the standard deviations and interquartile ranges are almost identical in all three splits.

Table A5 in Appendix A confirms the above findings: Motivated by (1), we regress the expected shutdown durations on the above proxies for potential sources of differing information about the shutdown length, the measures for firms' pre-pandemic general assessment of their businesses, and the proxies for firms' information processing capabilities jointly. This indicates no discernible effect of these observables, apart from a borderline significant effect of historical optimism in one out of two specifications. We therefore control for historical optimism in all subsequent specifications.

Overall, we have shown that the cross-sectional variation in shutdown duration expectations likely does not reflect private information, as firms did not expect the implementation of the first major pandemic-related policies earlier than the public, and as the reported expectations are unrelated to the idiosyncratic COVID-19 impact on firms' businesses and the local pandemic situation firms face. The cross-sectional variation in shutdown duration expectations is also orthogonal to firms' short- and long-run assessments of their business situation before the pandemic. In addition, expectations do not vary with proxies for firms' information processing capabilities. Of course, because we do not observe firms' entire information set, we cannot rule out the possibility that there was some sort of private information determining the variation of shutdown expectations. It is difficult to see, however, where this information may have come from, given that even policy makers were fundamentally uncertain about the progression of the crisis. It is thus plausible that the cross-sectional variation in the expected shutdown duration reflects the optimism or pessimism of firms' managers regarding the future policy response to the crisis, so that the variation in shutdown duration expectations is indeed sentiment-driven.

The directed acyclical graph (DAG) in Fig. 4 summarizes the identification strategy. So far, we have argued that the variation in the expected shutdown duration reflects optimism and pessimism regarding the future policy response to the pandemic. This is the key assumption of the empirical strategy going forward. The DAG reflects these arguments via the crossed-out dashed line between the initial COVID-19 impact on firms businesses and the expected shutdown duration: As

we have argued (e.g., via Fig. 1), there is no correlation between the idiosyncratic or sector-level initial impact of COVID-19 on firms' businesses and their assessment of the shutdown length. This crossed-out path should be interpreted as being representative for similar checks carried out in this section, which, for conciseness, are omitted from the DAG.

The DAG also clarifies the interpretation of the empirical results carried out in the next section. First, we estimate the effect of optimism / pessimism regarding the shutdown length (as embodied in the expected shutdown duration) on firms' business outlook, specifically the expected revenue effect of COVID-19 and the general business expectations. This assesses whether the differences in sentiment regarding the shutdown length are reflected in the more general business outlook, or whether firms mostly disregard their reported expected shutdown length, potentially realizing that they are based on little reliable information. The DAG also clarifies that optimism or pessimism regarding the shutdown duration is only one potential factor driving firms' business outlook; there may be other factors like the already realized COVID-19 impact or other types of information like the mid-term business prospects independent of the COVID-19 shock. Also note that the DAG explicitly allows for a link between firms' general optimism and pessimism and the optimism or pessimism regarding the shutdown length, reflecting the slight results in this regard from Fig. 2 and Table A5 in Appendix A. We account for this by controlling for general optimism and pessimism in all empirical specifications.

Second, we focus on estimating the *overall* effect of sentiment about the shutdown duration on business decisions. To do so, measures for the business outlook are not part of the control vector in the main empirical analysis. As a consequence, our estimates will be informative about both the direct effect of optimism and pessimism on business decisions as well as any potential indirect effects via firms' business outlook, as identified in the first step of the analysis.

4. Empirical analysis: sentiment and firm behavior

In this section, we analyze the effects that the sentiment-driven expectations regarding the duration of restrictions on public life had on firms' business outlooks and on their managerial decisions to cope with the COVID-19 crisis. In particular, we focus on answering two questions: First, to which extent is the sentiment regarding the shutdown duration reflected in firms' general business outlook? Second, did the sentiment regarding the shutdown duration also influence the choice of strategies that firms implemented to manage the crisis?

To analyze these questions, we estimate the following empirical model that is motivated by the identification strategy described in the previous section:

$$Y_i = \beta_1 \times \mathbb{1}[E_i(\text{SD Duration}) \in (2m, 4m]] + \beta_2 \times \mathbb{1}[E_i(\text{SD Duration}) > 4m] + \gamma X_i + \alpha_c + \alpha_s + \delta_t + \varepsilon_i. \quad (2)$$

Here, the dependent variable Y_i refers to different measures for firm i's general business outlook or managerial decisions. The main covariate of interest is the expected shutdown duration $E_i(\text{SD Duration})$ that is most plausibly sentiment-driven, as shown in Section 3. To capture potentially non-linear effects, we estimate the effect of firms expecting a shutdown duration of either between two and four months or more than four months relative to the baseline group expecting the shutdown to last at most two months. Given that the initial impact of the COVID-19 crisis is a natural predictor for future business developments and the choice of managerial strategies in response to the crisis, the empirical specifications with forward-looking outcomes and with managerial responses include this variable in the control vector X_i.[15] Further, we control for the number of employees (in logs), the export share, pre-crisis business conditions, and historical optimism as defined in Section 3. Each linear regression includes a full set of industry fixed effects at the two-digit level (for 66 industries s), county fixed effects (for 397 counties c that are covered by our firm sample), and date-of-response fixed effects (dates t between April 2, and 23).

Hence, the effects of sentiment on firms' business outlook and decisions are estimated from the *residual variation* in the shutdown duration expectations. This residual variation is, by construction, orthogonal to many potential sources for why firms might disagree regarding the duration of pandemic-related policies, which are collected in the control vector. While the analysis of Section 3 showed that the variation in shutdown duration expectations is largely independent from variation in these observables, we also control for the borderline significant effect of historical optimism on expected shutdown durations documented in Table A5 in Appendix A. Moreover, the fixed effects do not only purge for the observed incidence rate and stringency of containment measures at the level of counties, but flexibly control for any unobserved differences in the sectoral and regional exposure to the crisis, as well as for differences in information and crisis management depending on the exact survey date.

4.1. Effects of sentiment about shutdown duration on business outlook

We first analyze the effect of optimism / pessimism regarding the shutdown length on the general business outlook. In particular, we test whether firms' sentiment regarding the shutdown duration is also reflected in their expectations regarding the effect of the crisis on their revenues in 2020 and on their general business expectations for the next six months. Recall from the discussion of the directed acyclical graph in Fig. 4 that this is not clear ex ante: On the one hand, firms may

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[15] For illustrative purposes and because comparatively few firms indicate that they are positively affected by the crisis, we group firms according to their COVID-19 impact (measured by integers between −3 ӕnegative impactᵷ and 3 ӕpositive impactᵷ) into the categories ӕvery negativeᵷ (−3), ӕnegativeᵷ (−2 and −1), and ӕpositiveᵷ (+1 to +3); an impact of zero serves as baseline.

Table 1

Effects of sentiment about shutdown duration on business outlook.

	COVID-19 Impact		COVID-19 Revenue Effect		Business Expectations	
	(1)	(2)	(3)	(4)	(5)	(6)
Expected shutdown duration (baseline: ≤ 2 months):						
2 - 4 months		-0.046		-0.021***		-0.028
		(0.061)		(0.005)		(0.026)
> 4 months		-0.107*		-0.052***		-0.127***
		(0.059)		(0.010)		(0.025)
COVID-19 impact (baseline: neutral):						
very negative			-0.254***	-0.251***	-0.427***	-0.429***
			(0.011)	(0.010)	(0.037)	(0.037)
negative			-0.114***	-0.112***	-0.324***	-0.323***
			(0.008)	(0.008)	(0.037)	(0.038)
positive			0.097***	0.098***	0.275***	0.275***
			(0.011)	(0.012)	(0.053)	(0.053)
Business Conditions Q4/19 (baseline: neutral):						
negative	-0.257***	-0.254***	-0.024***	-0.022***	-0.057*	-0.054
	(0.055)	(0.056)	(0.006)	(0.007)	(0.034)	(0.033)
positive	0.348***	0.346***	0.021***	0.021***	0.150***	0.150***
	(0.047)	(0.047)	(0.006)	(0.006)	(0.019)	(0.018)
Firm characteristics:						
ln(Employees)	0.024	0.023	0.015***	0.014***	-0.000	-0.001
	(0.019)	(0.019)	(0.002)	(0.002)	(0.009)	(0.008)
Export Share	-0.436**	-0.407**	-0.033**	-0.030**	0.122**	0.131**
	(0.173)	(0.172)	(0.014)	(0.013)	(0.053)	(0.052)
Historical Optimism (2012–2019)	-0.011	-0.017	0.006	0.003	0.185***	0.185***
	(0.072)	(0.073)	(0.007)	(0.007)	(0.018)	(0.018)
Constant	-1.611***	-1.578***	-0.131***	-0.112***	-0.314***	-0.266***
	(0.081)	(0.105)	(0.009)	(0.011)	(0.042)	(0.042)
County FE	yes	yes	yes	yes	yes	yes
Industry FE	yes	yes	yes	yes	yes	yes
Date FE	yes	yes	yes	yes	yes	yes
N	4652	4575	4496	4452	4619	4544
Adj. R2	0.142	0.143	0.454	0.462	0.157	0.166

Notes: The dependent variables are firms' survey responses in April 2020 on the degree their businesses were affected by the COVID-19 crisis (elicited on a scale between -3 and 3), firms' expected impact of the crisis on revenues in 2020 (revenue increase/decrease as share of total revenue), and firms' business conditions for the next six months elicited on a (-1 "negative", 0 "neutral", 1 "positive"). The expected shutdown duration is driven by sentiment and unrelated to fundamentals (see Section 3 for details). When the direct *COVID-19 impact* is used as a control variable, we group the seven-point scale into the categories "very negative" (-3), "negative" $(-2$ and $-1)$, and "positive" $(+1$ to $+3)$; an impact of zero serves as baseline. In addition to the controls listed in the table, all empirical models include fixed effects at the levels of dates, counties, and two-digit industries. Standard errors clustered at the level of two-digit industries in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.
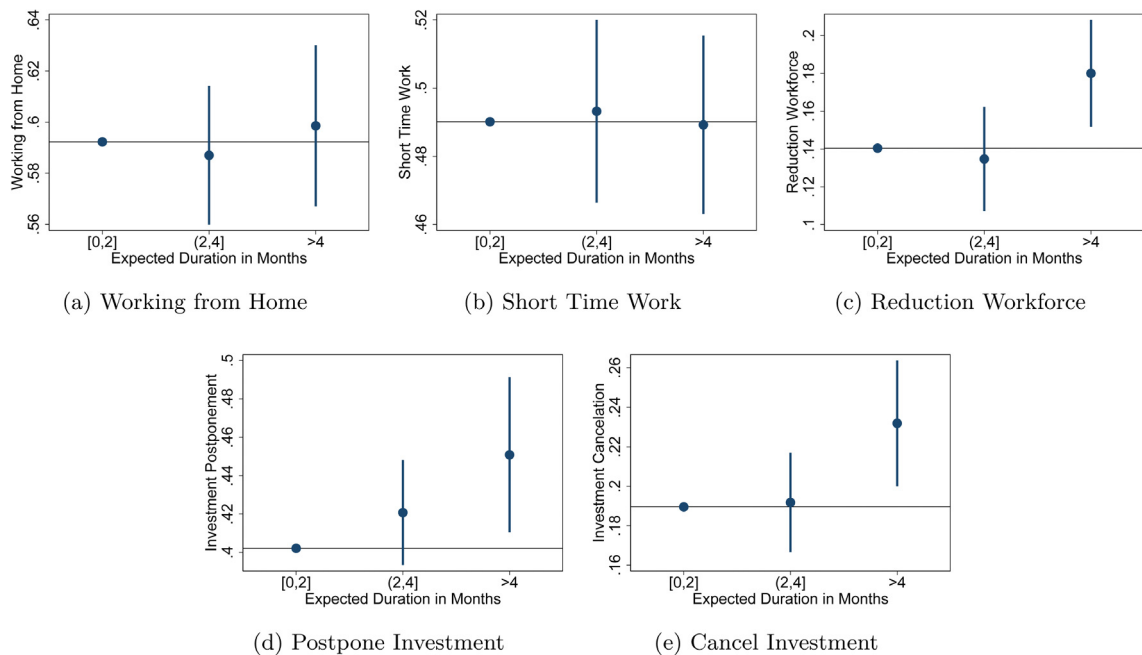
realize that their expectations regarding the shutdown duration are based on little reliable information and hence may put little weight on these expectations when forming more general beliefs about the future development of their businesses. On the other hand, firms may incorporate their shutdown duration expectations into their general business outlook either because they lack other information regarding the further progression of the crisis or because they can hardly distinguish whether these perceptions are driven by information or optimism / pessimism. In this case, we hypothesize that a longer (sentiment-driven) expected shutdown duration should lead to a less favorable business outlook on average. This is because the vast majority of firms are negatively affected by COVID-19 as shown in Fig. 1.

We also test whether the initial impact of the crisis is independent of the shutdown duration expectations. This should be the case because the initial impact is already realized while shutdown duration expectations are forward-looking.

Table 1 reports the full set of estimates for these empirical models. Confirming the argument just made, Column (2) shows that the sentiment regarding the shutdown duration correlates at best weakly with the reported initial impact of the COVID-19 pandemic on businesses.

In contrast, the sentiment regarding the shutdown duration exhibits a statistically and economically significant effect on both forward-looking variables—the expected effect of the crisis on revenues in Column (4) and expected business conditions in Column (6). Quantitatively, the negative revenue effect predicted by firms that expected a long duration of more than four months exceeds that of baseline firms by five percentage points. The substantial magnitude of this differential effect highlights that firms incorporate the optimism / pessimism regarding the shutdown duration in their more general business outlook. Moreover, as we discussed in the context of Fig. 4, the effect of the specific sentiment regarding the shutdown duration on the general business outlook may be one way of how the former impacts firms' business decisions. We investigate this issue in the next subsection.

Before doing so, two additional findings are worth pointing out: As hypothesized, the initial impact of the COVID-19 crisis as of April 2020 proves to be a strong predictor for the expected revenue effect and business expectations. In addition,

(a) Working from Home   (b) Short Time Work   (c) Reduction Workforce

(d) Postpone Investment   (e) Cancel Investment

Fig. 5. Effects of Sentiment about Shutdown Duration on Managerial Decisions. *Notes:* The figure shows the effect of firms' sentiment-driven expected shutdown duration (see Section 3 for details) on the fraction of firms that applied the respective crisis response strategies. Estimations control for the direct COVID-19 impact, firms' pre-crisis business conditions in 2019:Q4, firms' size and export share, firms' historical optimism and fixed effects at the levels of dates, counties, and two-digit industries. The predicted values for a firm expecting a shutdown of less than two months and average firm characteristics serve as baseline. Confidence intervals are depicted at the 95-percent level. The estimates refer to Table 2.

pre-crisis overall firm health affects both the initial business impact of the crisis and firms' outlook conditional on the initial impact. The latter finding is consistent with—but no hard proof for—the notion that less healthy firms are more constrained in their means to manage the crisis.

The odd columns of Table 1 show the results when omitting the expected shutdown duration. The differences in the coefficient estimates between the respective odd and even columns are negligible, emphasizing the point of Section 3: Shutdown duration expectations are by and large orthogonal to observable firm characteristics, consistent with the interpretation that they are driven by sentiment.

4.2. Effects of sentiment about shutdown duration on managerial decisions

Given the effects of sentiment regarding the shutdown duration on the business outlook shown in the previous section, we now tackle the following question: Did the perceived shutdown length also influence the choice of strategies that firms implemented to cope with the crisis?

To answer this question, we estimate the effects of sentiment about the shutdown duration on the prevalence of firms' choices in the domains of employment and investment. We hypothesize that the expected shutdown duration should primarily explain differences in the prevalence of those managerial responses that are costly to reverse: Managers should be more likely to implement less reversible strategies if they anticipate the crisis to last longer.

We consider the following potential managerial responses to the COVID-19 crisis in the employment domain: working from home, short time work, and workforce reductions. These strategies differ in terms of their severity and reversibility. Having employees work from home is easily reversible and does not affect salaries paid and hours worked. Short time work is a government scheme that permits firms to temporarily reduce working hours with a corresponding reduction in pay, and compensates part of employees' foregone earnings. This scheme allows firms to retain their workforce at times of lower demand without paying the salary in full. This strategy thus is easy to reverse. Finally, layoffs affect the level of employment more permanently, while saving the entirety of salary costs.

In terms of managing investment, we consider either the postponement or the cancellation of investment projects. As for the employment responses, the investment measures differ in their severity and reversibility: Naturally, it is more costly to reactivate a canceled investment project than to accelerate projects that had only been postponed. At the same time, when canceling projects, firms are likely to retain more of the investment expenditures than when merely postponing them.

Fig. 5 plots the partial effect of sentiment about the shutdown duration on crisis response strategies. These effects are shown relative to the predicted prevalence for a firm expecting a shutdown duration of less than two months, with all other control variables fixed at their average values. Table 2 reports the corresponding full set of estimates.

Table 2

Effects of sentiment about shutdown duration on managerial decisions – full regression results.

	Working from Home	Short Time Work	Reduction Workforce	Postpone Investment	Cancel Investment
	(1)	(2)	(3)	(4)	(5)
Expected shutdown duration (baseline: ≤ 2 months):					
2 - 4 months	-0.005	0.003	-0.006	0.019	0.002
	(0.014)	(0.014)	(0.014)	(0.014)	(0.013)
> 4 months	0.006	-0.001	0.040***	0.049**	0.042**
	(0.016)	(0.013)	(0.014)	(0.021)	(0.016)
COVID-19 impact (baseline: neutral):					
very negative	-0.028	0.599***	0.181***	0.272***	0.225***
	(0.038)	(0.028)	(0.020)	(0.024)	(0.021)
negative	0.018	0.296***	0.075***	0.181***	0.085***
	(0.031)	(0.026)	(0.014)	(0.027)	(0.016)
positive	0.009	-0.075***	-0.026*	-0.065**	-0.003
	(0.036)	(0.021)	(0.014)	(0.025)	(0.016)
Business Conditions Q4/19 (baseline: neutral):					
negative	-0.041**	0.073***	0.061***	0.014	0.062***
	(0.018)	(0.023)	(0.015)	(0.030)	(0.021)
positive	0.011	-0.018	-0.021*	-0.027*	-0.054***
	(0.018)	(0.016)	(0.012)	(0.016)	(0.018)
Firm characteristics:					
ln(Employees)	0.096***	0.035***	0.032***	0.039***	0.018***
	(0.008)	(0.005)	(0.004)	(0.005)	(0.005)
Export Share	0.157***	-0.016	0.008	-0.042	-0.020
	(0.047)	(0.050)	(0.032)	(0.063)	(0.043)
Historical Optimism (2012–2019)	0.015	0.038***	0.002	-0.008	-0.012
	(0.016)	(0.012)	(0.009)	(0.021)	(0.016)
Constant	0.247***	0.042	-0.067**	0.103***	0.018
	(0.041)	(0.032)	(0.028)	(0.032)	(0.030)
County FE	yes	yes	yes	yes	yes
Industry FE	yes	yes	yes	yes	yes
Date FE	yes	yes	yes	yes	yes
N	4575	4575	4575	4575	4575
Adj. R2	0.311	0.339	0.146	0.097	0.087

Notes: The dependent variables are firms' survey responses in April 2020 on whether or not they implemented the following strategies in response to the crisis: increased work from home, short time work, reduction of workforce (e.g., lay-offs, desist from extensions), postponement of investment projects, and cancellation of investment projects. The expected shutdown duration is driven by sentiment and unrelated to fundamentals (see Section 3 for details). In addition to the controls listed in the table, all empirical models include fixed effects at the levels of dates, counties, and two-digit industries. To flexibly control for the direct *COVID-19 impact*, we group its seven-point scale into categories "very negative"(−3), "negative" (−2 and −1), and "positive" (+1 to +3); an impact of zero serves as baseline. Standard errors clustered at the level of two-digit industries in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

In the employment domain, variation in sentiment regarding the shutdown duration only explains firm-level differences in layoffs: In contrast to work from home or short time work, these are difficult to reverse quickly, and should thus predominantly be undertaken by managers that expect the shutdown to last longer. In line with this, the prevalence of layoffs increases by more than four percentage points if firms expected the shutdown to last more than four months. In other words, these firms were about 29 percent more likely to reduce their workforce compared to an otherwise comparable firm anticipating a quick return to normalcy within less than two months.

Sentiment about the shutdown duration has statistically significant effects on the decision to postpone or cancel investments. Specifically, if firms perceived the shutdown to last four months or longer, they were about five percentage points more likely to postpone and about four percentage points more likely to cancel investment projects compared to firms that expected the shutdown to last for two months at most. Relative to the average prevalence of both crisis response strategies, the effect of sentiment is much larger for the less reversible strategy of canceling investments (implemented by 21 percent of average firms) than for the more reversible strategy of postponing investments (implemented by 43 percent of firms).

To learn more about the mechanism behind these managerial decisions, Table A7 in Appendix A includes three factors pertaining to revenue expectations as additional covariates: one indicator for whether expected revenue losses exceed the median of 20 percent, one indicator for whether firms expected to partially recover the lost revenue, and the interaction of both indicators. These revenue expectations explain variation in the prevalence of all crisis response strategies with the exception of working from home, similar to the effects of the initial COVID-19 impact. At least for liquidity-saving short time work and layoffs this should be expected, because firms react to the expected loss of revenues and the resulting liquidity concerns.

Besides the effects of sentiment, three additional findings are worth pointing out: First, firms' pre-crisis health is a strong predictor of firms' response to the COVID-19 crisis. Firms with bad conditions in 2019:Q4 were more likely to implement policies that save wage payments and investment costs. Among firms in bad pre-crisis health, the prevalence of short time

work increases by 1/5 of the predicted prevalence for the average firm, while the likelihood of layoffs and cancelation of investment projects increases by more than 1/3. This general pattern can also be found for the strategy of postponing investments, albeit at much smaller magnitudes. Firms with bad business conditions in 2019:Q4 were also less likely to implement working from home, but this effect is comparatively small given the widespread adoption of this managerial response to the crisis. Moreover, this may reflect that short time work and working from home are partial substitutes.

Second, larger firms were more likely to implement either of the measures. This is most likely due to the larger managerial resources of larger firms. In particular, we find that large firms were more likely to reduce employment, ceteris paribus. Since we only measure whether firms reduce employment but not by how much, we cannot infer how much of the aggregate reduction of employment is due to small and large firms, respectively. Evidence based on employee-level data in Alstadsæter et al. (2020) suggests that in Norway, employees of small firms were more likely to be laid off during the initial phase of the COVID-19 crisis.

Third, firms that had already been hit more adversely by the crisis were more likely to send workers on short time work, to lay off parts of their workforce, and to postpone or cancel investment projects. The absence of an effect of the initial crisis impact on the prevalence of working from home is plausible as the feasibility of this managerial response is heavily linked to workers' tasks[16] and, in addition, such policy was generally regarded as mandatory whenever possible.

Since a minority of 20 percent of firms reported that they were not negatively affected by the crisis, we investigate whether the effects of the expected shutdown duration on managerial decisions is heterogeneous depending on how firms were affected by the crisis.[17] It is plausible that firms that profited from the crisis reacted differently in terms of employment and investment decisions. Table A8 in Appendix A contains the results. They indicate no heterogeneity with respect to the effects on the likelihood of using working from home and short time work.[18] In contrast, there is heterogeneity regarding how expected shutdown duration affects the other three managerial choices that we look at. First, the expectation of a longer shutdown leads to a smaller increase in the likelihood of reducing the workforce when a firm was initially not negatively affected by the crisis. Second, such firms were also more likely to postpone investment projects instead of canceling them. Overall, the results show that not being negatively affected by the crisis in April 2020 slightly mitigates the strength of the effect of the expected shutdown duration on managerial decisions that are not easily reversible—albeit not so strongly that the direction of the effects would be reversed.

5. Conclusion

This paper studies how sentiment-driven expectations affected firms' business decisions in the wake of the COVID-19 crisis using a large representative panel of German firms. We show that the cross-sectional variation in expectations regarding the duration of the shutdown most likely reflects sentiment because these expectations are unrelated to the initial impact of the crisis on firms' businesses, pre-crisis business conditions and macroeconomic expectations, the pandemic situation in the firm's location as well as firm characteristics such as firm size, firm age, or export orientation. We then show that sentiment about the duration of the shutdown implemented in response to the COVID-19 pandemic influenced firms' business outlook for the coming months and their choice of strategies for coping with the crisis: Firms that anticipated the shutdown to last four months or longer were more likely to implement costly and permanent measures, in particular layoffs and the cancellation of investment projects. In contrast, easily reversible measures, such as having employees work from home, or temporary reducing wage costs through the short time work scheme, were implemented independently of the expected duration of the shutdown. Of course, the degree to which firms act as a result of changes in expectations is likely to vary across countries due to cultural or institutional factors. For instance, the response elasticities of particular managerial measures, most likely, depend on labor market regulations that determine how easy or costly the particular managerial decisions are.

Recent theoretical models suggest that the link between sentiment-driven expectations and behavior is an important driver of aggregate economic activity (e.g., Angeletos and La'O, 2013; Benhabib et al., 2015). While the existence of such a link has been established for households (e.g., Gillitzer and Prasad, 2018; Makridis, 2019; Mian et al., 2022), the literature has thus far been silent about whether such a link also exists for firms. Indeed, it is not trivial that firms behave similar to households in this respect: Recent work by Link et al. (2021) and Savignac et al. (2021) suggests that firms are more sophisticated in forming expectations than consumers. This could imply that firms may realize that some components of their expectations are more strongly backed by information than others, and business decisions may only be based on those components of expectations that firms perceive as being backed by sufficiently solid information. This paper presents first evidence to the contrary and establishes that sentiment can be an economically relevant factor for explaining firms' business decisions.

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[16] Recall that all empirical specifications include industry fixed effects, so that industry-level difference in the suitability of working from home as well as industry-level differences regarding the initial COVID-19 impact are filtered out.

[17] 9.5 percent of firms reported that their business was positively affected by the crisis, 10.3 percent reported a neutral impact, and 80.3 percent of firms reported a negative impact. As the shares of positively and neutrally affected firms are comparatively small, we group both categories together.

[18] The interaction term between firms being non-negatively affected by the crisis and expecting the shutdown to last between two and four months is significantly negative at the 10%-level. As the interaction term is insignificant again for firms expecting a shutdown of more than four months, we do not interpret this in favor of a clear heterogeneity effect.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplementary material

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jebo.2022.01.011

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